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Amendment and Request for Reconsideration

REMARKS

Claims 1-5, and 7-17 are pending in this application. Claims 18-49 were withdrawn in a previous Office Action response to a restriction requirement wherein the Applicant elected Claims 1-17. Applicant reserves the right to file continuing applications directed to the non-elected claims, Claims 18-49.

By this amendment Applicant has canceled Claim 6 and amended Claims 1, 2, 3, 4, 5, 15, and 16 to more particularly point out and distinctly claim the subject matter which the applicant regards as his invention. The claim amendments are fully supported in the specification (see for example, page 10, lines 14-17 of the pending application) and no new matter has been added.

Allowable Subject Matter

Applicant would like to thank the Examiner for finding that Claims 2-5 contain patentable subject matter and, if amended, are patentable. The Examiner objected to Claims 2-5 as being dependent upon a rejected base claim, Claim 1, but indicated that they would be allowable if rewritten into independent form. Applicant has rewritten Claims 2-5, as suggested by the Examiner, rewriting them in independent form including all of the limitations of their base claim, Claim 1. Thus, Applicant respectfully submits that Claims 2-5, as amended, are patentable and in condition for allowance.

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Claim Rejections under 35 USC § 112

Claim 6 was rejected under 35 USC § 112. By this amendment Applicant has canceled Claim 6, rendering the rejection moot.

Claim Rejections under 35 USC § 102

Claims 1, 10, 11, and 15 were rejected under 35 USC § 102(a) as being anticipated by U.S. Patent No. 6,665,049 to Takahashi ("Takahashi"). The Examiner asserted that Takahashi shows exposing measurement fiducials of an encoded face of an optical element onto a sensing plane.

Takahashi describes producing a "photomask which has a sufficient durability to short-wavelength exposure beams" that can also "prevent any foreign matter from adhering to patterns" on the photomask (Takahashi, Col. 3, lines 8-11). Takahashi describes improvements to pellicles, which are devices that protect a photomask from damage and contamination during handling operations. Takahashi also describes techniques to "correct aberrations" of the projection exposure apparatus "including the thick transmitting plate 3" or pellicle by "constructing part of the projection optical system PL" such that "they are slightly movable in the direction of the optical axis AX" (Takahashi, Col. 19 lines 34-51).

To determine the desired location of the moveable optical system, Takahashi describes exposing a reticle pattern "through the transmitting plate 3 and the projection objective lens PL to form on the wafer 19 a pattern image of the test reticle TR1." See Takahashi, Figure 7 and Col. 22, lines 35-40. The exposed pattern is then developed

and measured and “[t]hereafter, the adjustments of intervals of optical members and the adjustments of tilt-shift of the optical members are made in accordance with the information of the resist pattern image thus measured to correct aberrations other than the random components of distortion” (Takahashi, Col. 22 lines 40-46).

Takahashi describes “illuminating the pattern region on the pattern surface 1P of the reticle 1 in a uniform illumination distribution via an illumination system having an optical integrator (homogenizer).” (Takahashi, Col. 18 lines 29-30). In contrast to the uniform illumination of Takahashi, Claim 1 recites “producing an illumination source at low partial coherence.” Figure 2 of the pending application shows an illumination matching optic (IMO) 202 that produces a low partial coherence illumination that is unlike light produced from a homogenized illumination system. See the pending application at page 10, lines 18-20.

In addition, in Takahashi the illumination source rays are uniformly distributed across the reticle. In contrast, Claim 1 as amended recites an illumination source and optical element that cooperate to produce “narrow ray bundles that have chief rays at angles that vary regularly as a function of position on the encoded face” of a reticle (see also page 9, line 21 - page 10, line 7). This feature is illustrated, for example, in Figure 2, which shows chief rays C1 and C2 at angles that vary from each other, as a function of reticle position.

Likewise, Claim 15 recites “directing a plurality of narrow light ray bundles, each light ray bundle includes a chief ray, onto a plurality of locations on a reticle with a plurality

of measurements fiducials encoded onto a face of the reticle, wherein the chief ray angles incident at the plurality of locations on the reticle differ." This is in contrast to the uniformly distributed illumination source in Takahashi.

Thus, because all of the limitations of Claims 1 and 15 are not disclosed by Takahashi, Claims 1 and 15 are not anticipated by Takahashi. In addition, because Claims 10 and 11 depend directly from Claim 1, they are also not anticipated by Takahashi. Therefore, Applicant respectfully submits that Claims 1, 10, 11, and 15 are patentable over Takahashi and in condition for allowance.

Claim Rejections under 35 USC § 103

Claims 7-9

The examiner rejected Claims 7-9 under 35 USC § 103(a) as being unpatentable over Takahashi in view of U.S. Patent Application Publication No. 2001/0017693 to Zheng ("Zheng").

Claims 7-9 depend directly from Claim 1, thereby incorporating all of the limitations of Claim 1. As noted in the discussion of Claim 1, Takahashi describes an apparatus with a uniform illumination distribution, whereas Claim 1 recites "producing an illumination source at low partial coherence" with "narrow ray bundles that have chief rays at angles that vary regularly as a function of position on the encoded face" of a reticle. Thus, Takahashi does not show all of the recited features of the claim. The addition of Zheng does not overcome the deficiencies of Takahashi.

First, there is no suggestion or motivation to combine the teachings of Takahashi and Zheng. As noted by the Examiner, Zheng discloses in Figure 1 fiducials that are squares and describes methods for "determining image displacement accuracy following a change in reticle and illumination" (paragraph 0009). However, the methods described by Takahashi do not require using overlay targets, as described in Zheng, to measure feature shifts because Takahashi describes using a "coordinate measuring instrument" that measures pattern shift relative to a known origin. (Takahashi, Col. 22, line 41-42). Therefore the overlay targets described by Zheng would be of no benefit to the methods of Takahashi, and there would be no reason to combine the two. Moreover, Zheng's overlay targets would not be compatible with Takahashi's measurement instrument.

Even if Takahashi and Zheng were combined, they would not provide all of the limitations of Claims 7-9. Neither Takahashi nor Zheng describe "producing an illumination source at low partial coherence" with "narrow ray bundles that have chief rays at angles that vary regularly as a function of position on the encoded face" of a reticle.

Thus, neither Takahashi nor Zheng, individually or in combination, describe all of the limitations of Claims 7-9. Thus, Claims 7-9 are patentable over Takahashi and Zheng, taken individually or in combination, and are in condition for allowance.

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Claims 12-14, 16, and 17

The examiner rejected Claims 12-14, 16, and 17 under 35 USC § 103(a) as being unpatentable over Takahashi in view of U.S. Patent Application Publication No. 2002/0171815 to Matsuyama (“Matsuyama”).

Claims 12-14 depend, either directly or indirectly, from Claim 1. As noted above, Takahashi describes an apparatus with a uniform illumination distribution. In contrast, Claim 1 recites “producing an illumination source at low partial coherence” with “narrow ray bundles that have chief rays at angles that vary regularly as a function of position on the encoded face” of a reticle. This feature is missing from Takahashi. The addition of Matsuyama does not overcome the deficiencies of Takahashi.

First, there is no suggestion or motivation to combine the teachings of Takahashi and Matsuyama. As noted by the Examiner, Matsuyama describes an illumination modifying optic and of an opaque disk with a hole (Figure 2, reference 7L) or a diffuser (paragraph 0493). However, the modifications and exposures suggested by Matsuyama would not improve the techniques described by Takahashi because Takahashi does not require an illumination modifying optic. In fact, the use of a modifying optic, such as a disc with a hole, would corrupt the techniques of Takahashi because the pattern placement is related by the effective source size. Therefore, Takahashi and Matsuyama are not compatible.

Even if Takahashi and Matsuyama were somehow combined, they would not provide all of the limitations of Claims 12-14. Neither Takahashi nor Matsuyama describe

“producing an illumination source at low partial coherence” with “narrow ray bundles that have chief rays at angles that vary regularly as a function of position on the encoded face” of a reticle. In contrast, Matsuyama’s illumination source is “made to be an even intensity distribution” (Matsuyama, paragraph 0139). Matsuyama also describes that “the exposure amount unevenness can be smoothed by vibrating the vibration mirror 7D in synchronization with the moving of the reticle and the wafer” (Matsuyama at paragraph 0140).

Thus, Applicant respectfully submits that neither Takahashi nor Matsuyama, individually or in combination, describe all of the limitations of Claims 12-14. Thus, Claims 12-14 are patentable over Takahashi and Matsuyama, individually or in combination, and are in condition for allowance.

Claim 16 is an independent claim and Claim 17 depends from Claim 16. Claim 16 recites a similar limitation to Claim 1 where light passing through an “illumination modifying optic and condensing lens forms a plurality of light ray bundles with corresponding chief rays” such that the “angles of incidence of the chief rays within the respective bundles vary sufficiently to overfill a pupil of the optical element and the angles of the chief rays vary regularly as a function of position on the encoded face.”

For similar reasons as discussed in relation to Claim 1, Applicant respectfully submits that neither Takahashi nor Matsuyama, individually or in combination, describe all of the limitations of Claim 16. Thus, Claim 16 is patentable over Takahashi and Matsuyama, individually or in combination, and is in condition for allowance. In addition,

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because Claim 17 depends directly from Claim 16, Claim 17 is also patentable over Takahashi and Matsuyama, individually or in combination, and is also in condition for allowance.

Conclusion

Applicant respectfully submits that all the pending claims in the application, Claim 1-5, and 7-17, are in condition for allowance. Reconsideration and further examination of the application are requested. A Notice of Allowance is solicited.

Respectfully submitted,
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